

**Multipass Geometry and Constructions for Diode-Pumped Solid-State  
Lasers and Fiber Lasers, and for Optical Amplifier and Detector**

**ABSTRACT**

In order to effectively solve thermal distortion problems and obtain high-power  $TEM_{00}$ -mode operations for DPSS lasers, two major steps are presented in this invention. First, novel multipass pumping approaches and corresponding engineering designs have been developed for slab lasers and thin-disk lasers. They are characterized by using multipass and zig-zag pumping paths and confining pumping beams substantially via total-internal-reflection (TIR) to significantly reduce multiple reflection losses. Second, a zig-zag slab laser in combination with a beam-expanding cavity is employed to realize mode-matching pumping and maximize the energy extraction from laser slabs. It also leads to achieving high-power intracavity frequency conversions over wide spectral ranges and producing red and blue visible lasers with the aid of minimizing spatial hole burning. Besides, the invented optical multipass geometry and TIR-guide constructions can also be utilized for pumping rod lasers, fiber lasers and fiber amplifiers, and for optical amplifiers and optical or spectral detectors.